

IN THE CLAIMS

1. (currently amended) A system to automatically inspect an optical mask, ~~said the~~ system comprising:
 - ~~a~~ a film coating system to apply a conductive coating to a top surface of ~~said the~~ optical mask to produce a conductive optical mask;
 - a grounding strap to connect ~~said the~~ conductive coating of ~~said the~~ conductive optical mask to electrical ground;
 - a field emission electron source to provide an electron beam; a charged particle beam column to deliver and scan ~~said the~~ electron beam from ~~said the~~ field emission electron source on a top surface of ~~said the~~ conductive coating;
 - a backscatter electron detector to detect backscattered electrons from ~~said the~~ conductive optical mask to generate a backscatter electron waveform as ~~said the~~ electron beam scans ~~said the~~ conductive optical mask;
 - a secondary electron detector to detect secondary electrons from ~~said the~~ conductive optical mask to generate a secondary electron waveform as ~~said the~~ electron beam scans ~~said the~~ conductive coating; and
 - a processor to examine ~~said the~~ backscatter electron waveform and ~~said the~~ secondary electron waveform to determine construction features of ~~said the~~ the conductive optical mask.
2. (currently amended) A system to automatically inspect an optical mask as in claim 1 wherein ~~said the~~ optical mask is a phase shift mask.
3. (currently amended) A system to automatically inspect an optical mask as in claim 1 wherein ~~said the~~ film coating system is a sputtering system.
4. (currently amended) A system to automatically inspect an optical mask as in claim 1 further comprising a memory connected to each of ~~said the~~ backscatter electron detector and ~~said the~~ secondary electron detector to store ~~said the~~ backscatter electron waveform and ~~said the~~ secondary electron waveform from ~~said the~~ conductive optical mask.

5. (currently amended) A method for automatically inspecting an optical mask, ~~said~~
~~the~~ method comprising the steps of:
 - (a): applying a conductive coating to a top surface of ~~said the~~ optical mask to produce a conductive optical mask;
 - (b): electrically grounding ~~said the~~ conductive coating;
 - (c): scanning an electron beam on a top surface of ~~said the~~ conductive coating of step (b);
 - (d): detecting backscattered electrons from ~~said the~~ conductive coating of step (c) to form a backscatter electron waveform;
 - (e): detecting secondary electrons from ~~said the~~ conductive coating of step (c) to form a secondary electron waveform;
 - (f): examining ~~said the~~ backscatter electron waveform and ~~said the~~ secondary electron waveform from steps (d) and (e); and
 - (g): determining construction features of ~~said the~~ conductive optical mask in response to step (f).
6. (currently amended) A method for automatically inspecting an optical mask as in claim 5 wherein ~~said the~~ optical mask is a phase shift mask.
7. (currently amended) ~~A. The method for automatically inspecting an optical mask as in of claim 5 wherein step (a) further includes the step of comprises b. sputtering~~ ~~said the~~ coating onto ~~said the~~ optical mask.
8. (currently amended) ~~A. The method for automatically inspecting an optical mask as in of claim 5 further including comprising the step of:~~
 - (i): storing each of ~~said the~~ backscatter electron waveform from step (d) and ~~said the~~ secondary electron waveform from step (e).
9. (currently amended) A method of inspecting a substrate, comprising:
 - (a) exposing ~~said the~~ substrate to a first group of electrons, ~~said the~~ first group of electrons causing ~~said the~~ substrate to emit electrons; and

- (b) exposing ~~said the~~ substrate to a second group of electrons, wherein ~~said the~~ second group of electrons reduces charging at a surface of ~~said the~~ substrate, ~~said the~~ charging resulting from ~~said the~~ emitted electrons.
10. (currently amended) The method of claim 9, wherein ~~said the~~ substrate is a semiconductor wafer.
11. (currently amended) The method of claim 9, wherein ~~said the~~ substrate includes an insulating region.
12. (currently amended) The method of claim 9, further comprising detecting ~~said the~~ emitted electrons.
13. (currently amended) The method of claim 12, wherein ~~said the~~ emitted electrons are secondary electrons.
14. (currently amended) The method of claim 12, wherein ~~said the~~ emitted electrons are backscattered electrons.
15. (currently amended) The method of claim 9, wherein ~~said the~~ first group of electrons is provided in the form of a beam incident upon ~~said the~~ substrate.
16. (currently amended) The method of claim 9, wherein ~~said the~~ second group of electrons are electrons from the substrate that are caused to return to the substrate by electrical field applied to an electrode near the substrate.
17. (currently amended) The method of claim 9, wherein ~~said the~~ substrate is maintained at a charge equilibrium condition by the combination of ~~said the~~ first group of electrons and ~~said the~~ second group of electrons.
18. (currently amended) The method of claim 17 wherein ~~said the~~ charge equilibrium condition is set to obtain favorable image statistics.

19. (currently amended) The method of claim 17 wherein ~~said the~~ equilibrium condition is affected by localized topographical and material differences on ~~said the~~ substrate.
20. (currently amended) The method of claim 17 wherein surface charging creates a potential which maintains ~~said the~~ equilibrium condition.
21. (currently amended) The method of claim 9, wherein ~~said the~~ charging is substantially caused by a rate of electron emission from ~~said the~~ surface that exceeds the rate at which ~~said the~~ first group of electrons arrives at ~~said the~~ surface.
22. (currently amended) The method of claim 12, further comprising processing signals resulting from ~~said the~~ detected electrons.
23. (currently amended) The method of claim 22 wherein ~~said the~~ signals are processed by comparison with a reference to detect defects present on ~~said the~~ substrate.
24. (currently amended) The method of claim 23 wherein ~~said the~~ reference is derived from a corresponding portion of ~~said the~~ substrate.
25. (currently amended) The method of claim 23, wherein ~~said the~~ reference is derived from a database from which ~~said the~~ substrate was designed.
26. (original) The method of claim 9, wherein the first group of electrons has a high landing energy.
27. (previously presented) The method of claim 26, wherein the second group of electrons has a low landing energy.
28. (previously presented) The method of claim 27, wherein the second group of electrons is in the form of a defocused beam.

29. (original) The method of claim 9, wherein the second group of electrons is produced by an intermediate electrode between a source of the electron beam and the substrate.
30. (previously presented) The method of claim 9 wherein the first group of electrons is a charged particle beam generated by a particle beam column which includes an aperture member to control a current level and spot size of the electron beam.
31. (canceled)
32. (canceled)
33. (currently amended) The system of claim 34 wherein the electron beam has a width in the range of ~~50nm-2000nm~~ about fifty nanometers to about two thousand nanometers.
34. (currently amended) A system to automatically inspect a substrate, ~~said the~~ system comprising:
 - an electron source to provide an electron beam at least ~~50nm~~ fifty nanometers wide;
 - a charged particle beam column to deliver and scan ~~said the~~ electron beam;
 - an electron detector to detect electrons from ~~said the~~ substrate as ~~said the~~ electron beam scans ~~said the~~ substrate; and
 - a processor to examine an image from ~~said the~~ detected electrons to determine features of ~~said the~~ substrate and wherein the processor further includes an image processor to compare images from two different locations on the substrate and determine the location of defects on the substrate when the comparison detects a difference.
35. (previously presented) The system of claim 34 wherein the substrate is a photomask.
36. (previously presented) The system of claim 34 wherein the substrate is a production wafer.

37. (currently amended) A system to automatically inspect a substrate, ~~said the~~ system comprising:

an electron source to provide an electron beam from a high brilliance source with an irradiance of greater than ~~4 milli-amp per steradian~~ about one milliamp per steradian;

a charged particle beam column to deliver and scan ~~said the~~ electron beam;

an electron detector to detect electrons from ~~said the~~ substrate as ~~said the~~ electron beam scans ~~said the~~ substrate; and

a processor to examine an image from ~~said the~~ detected electrons to determine features of ~~said the~~ substrate and wherein the processor further includes an image processor to compare images from two different locations on the substrate and determine the location of defects on the substrate when the comparison detects a difference.

38. (currently amended) The system of claim 37, wherein the beam produces an inspection spot on the substrate ~~which that is~~ at least ~~50nm~~ about fifty nanometers in width.

39. (currently amended) The system of claim 38, wherein the electron source provides an electron beam in the range of ~~50nm—2000nm~~ about fifty nanometers to about two thousand nanometers in width.

40. (currently amended) A system to automatically inspect a substrate, ~~said the~~ system comprising:

an electron source to provide an electron beam at least ~~50nm~~ about fifty nanometers wide;

a charged particle beam column to deliver and scan ~~said the~~ electron beam;

an electron detector to detect electrons from ~~said the~~ substrate as ~~said the~~ electron beam scans ~~said the~~ substrate, which is affixed to a stage;

a processor to examine an image from ~~said the~~ detected electrons to determine features of ~~said the~~ substrate and wherein the processor further includes an image processor to compare images from two different locations on the

substrate and determine the location of defects on the substrate when the comparison detects a difference; and
 a subsystem to receive feedback about the position of the stage and to correct the position of the electron beam with respect to the stage.

41. (original) The system of claim 40, further comprising an interferometer used to track the position of the stage.
42. (currently amended) A system to automatically inspect a substrate, ~~said the~~ system comprising:
 an electron source to provide an electron beam;
 a charged particle beam column to deliver and scan ~~said the~~ electron beam;
 an electron detector to detect non-reflected electrons from ~~said the~~ substrate as ~~said the~~ electron beam scans ~~said the~~ substrate; and
 a processor to examine an image from ~~said the~~ detected electrons to determine features of ~~said the~~ substrate and to compare the image to information from a database, disagreement between the image and the information from the database indicating a defect in the substrate.
43. (currently amended) The system of claim 42, wherein the beam produces an inspection spot on the substrate ~~which that is~~ at least ~~50nm~~ about fifty nanometers in width.
44. (original) The system of claim 43 wherein the inspection spot is in the range of 50nm.
45. (original) The system of claim 42, wherein the database is a CAD database that contains layout information for the pattern of the substrate under test.
46. (original) The system of claim 42 wherein the substrate is a photomask.
47. (original) The system of claim 42 wherein the substrate is a production wafer.
48. (original) The system of claim 42, where the processor includes an alignment processor to measure differences in alignment between a digitized version of the

- image and the information from the database and then to use the alignment measurement to align the image and the information from the database.
49. (currently amended) A method of automatically inspecting insulated surfaces of a substrate by controlling the build up of surface charge on the substrate, comprising:
- (a) performing an electron beam inspection of the substrate in multiple swaths, an electron beam dose per swath being selected to control the charge density;
 - (b) performing repeated swaths for a pattern feature of the substrate so as that the resulting multiple feature images are exactly aligned and can be overlaid precisely; and
 - (c) averaging the multiple image features to maximize signal contrast in the image of the pattern feature.
50. (currently amended) The method of claim 49, wherein ~~the performing step (a)~~ includes performing ~~an~~ the electron beam inspection of the substrate in multiple swaths, ~~an~~ where the electron beam dose per swath ~~being~~ is selected to minimize the charge density.
51. (currently amended) The method of claim 49, wherein an image of a pattern feature is produced by averaging between ~~2 to 256~~ about two and about two-hundred and fifty-six (inclusive) repeated frames.
52. (currently amended) The method of claim 51, wherein a frame size varies ~~in the range of from about 512 pixels to about 4096 pixels tall by about 4 to about 4096 pixels wide.~~
53. (original) The method of claim 49 wherein the substrate is a photomask.
54. (original) The method of claim 49 wherein the substrate is a production wafer.
55. (currently amended) A system for automatically classifying defects in a substrate, ~~said~~ the system comprising:

a subsystem to provide a high energy electron beam and a low energy electron beam from an electron source;

a charged particle beam column to deliver and scan ~~said the~~ high energy and ~~said the~~ low energy electron beams;

an electron detector to detect non-reflected electrons from ~~said the~~ substrate as one of ~~said the~~ high energy and ~~said the~~ low energy electron beams scans ~~said the~~ substrate; and

a processor to examine an image from ~~said the~~ detected electrons to determine features of ~~said the~~ substrate.

56. (canceled)

57. (canceled)

58. (canceled)

59. (currently amended) A method for inspecting insulating and thermally sensitive surfaces of a substrate, comprising:

- (a) performing an electron beam inspection of the substrate in multiple swaths, an electron beam dose per swath being selected to control thermal load per swath;
- (b) performing repeated swaths for a pattern region of the substrate so as that the resulting multiple region images are exactly aligned and can be overlaid precisely; and
- (c) averaging the multiple region images to maximize signal contrast in the image of the substrate.

60. (original) The method of claim 59 wherein the substrate is a photomask.

61. (original) The method of claim 59 wherein the substrate is a production wafer.

62. (previously presented) The system of claim 55 wherein the subsystem provides the high energy electron beam and the low energy electron beam non-simultaneously.